JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Pedestrians Safe Planning Proposal for Athwa to Court Stretch of South-West Zone, Surat City

[1]Drashti R. Patel, [2] Prof. Sejal S. Bhagat
[1] M. Tech. (Town and country Planning); Sarvajanik Collage of Engineering & Technology, Surat
[2] Assistant Professor (M. Tech - TCP), Civil engineering Department, Sarvajanik Collage of Engineering & Technology, Surat

Abstract : The rate of pedestrian accidents and injuries has increased due to growing urban population, escalating motor traffic, and inadequate pedestrian infrastructure. Pedestrian safety is one of the main concerns in the globe today. The goal of the research is to prepare a proposal for increasing Surat City's safety and pedestrian infrastructure. To find the area that needs safety improvement the most, the study looked into Pedestrians movement patterns, peak traffic hours, and high-pedestrian volume areas. The market, commercial area, educational area, and residential area are the four aspects that are used to pick the stretch. In this study, both primary and secondary data are employed. The AHP approach was applied to the data analysis. AHP helps researchers determine the most important parameters related to pedestrian safety. In line with the AHP approach, The most important factors influencing pedestrian safety in the city are, it has been determined. Connectivity, accessibility, safety, and comfort are all crucial factors to consider while using the Analytic Hierarchy Process (AHP) method in project planning develop safer roads in Surat city.

Index Terms: Pedestrians Safety, Safe crossing, Non-Motorized Transport, Pedestrians Facilities, Analytic Hierarchy Process (AHP)

1. Introduction

Currently, motorized transportation infrastructure (both public and private) is the subject of most study on urban mobility planning in emerging countries. Increased motorization is causing an increase in traffic accidents, environmental damage, and jams. Non-motorized transport, or NMT, is one of the best ways to lessen the negative effects of motorization. There are other non-motorized ways to get around, including as walking, bicycling, rickshaws, and vehicles pulled by animals. Non-motorized modes make use of locally available human and animal energy and are simple, safe, and non-polluting. One of the Gujarat cities that is expanding the fastest is Surat. Because of the mixed land use and congested areas, average pedestrian trips tend to cluster in various zones. In Surat, there are numerous footpaths, foot over bridges, and other developments. Congested crossings and a lack of secure areas for pedestrians are issues in Surat's southwest region.

2. Literature Review

Pedestrian comfort, safety, and freedom of movement are all directly impacted by vehicle traffic. quicker in pace Everywhere in the city, there has been an increase in car traffic, which has led to more accidents and less safety for pedestrians. As a result, preserving pedestrian safety is essential to the overall transportation system. (Shafna shukkoor, Sangeeth K, 2021). A key component of road design is the comprehensive integration of pedestrian needs and traffic challenges. preservation of nature and possibilities For cross-cultural exchange, a resource-conserving setting with efficient public transit and more walking options should be established. major objectives for urban planners. (Sejal bhagat, Manoj patel, Palak shah, 2014). Indian cities, traffic congestion is a problem. Public transportation is frequently despised for a variety of reasons, including inadequate frequency on connected routes, a lack of awareness regarding utilization, and others. The current street design on Sitabuldi Market Street, which is favored by pedestrians, is being examined to find issues pertaining to pedestrian movement. encountered by walkers, and extra measures are being taken by proposing a suitable roadway design to improve pedestrian circumstances. (Amruta kakirde, Omkar Parishwad, 2016).

3. Study area delineation

Surat is a city located on the western part of India in the state of Gujarat. Surat District's total area is 4,418 km ^{2}, and the density of Surat District was 1,376 per km ^{2} at the 2011 Census. The proportion of walk and cycle journeys is around 43%, which is extremely high, showing the city's compact and diversified land use growth. About 28% of work trips are made by two wheelers, whereas only 0.52% trips are made by PT. Work trips made by three wheelers contributes to 4.6%. For education purpose, about 13% of trips are made by walk and cycle.

In surat different zone has presents unique challenges and opportunity for enhancing pedestrian safety in surat. Pedestrian safety in different zone of surat requires considering various factor such as traffic volume pedestrian activity, infrastructure and landuse and accident data. Focusing on educational area, including area around school and collages in athwa and piplod, experience high pedestrian activity during school hours, necessity better traffic management and safe school zones. Selected specific stretch for detailed analysis based on filed observation and survey. Selection criteria prioritize stretch with high pedestrian activity, mixed traffic flow, and limited pedestrian infrastructure.

In the part of data collection pedestrian volume count survey is carried out for selected stretch of Athwa zone, Athwagate junction to court. survey was conducted for two consecutive days: Sunday, Monday. Characteristics in week day(Monday to Friday) is generally observed similar in nature, while for weekend(Sunday & Saturday) traffic characteristics and patterns are differ as compare to weekday.

Table 1 Critical Stretch Detail

Sr.no	Stretch name	Length	T.fatalites	Acci./km
1	HMC ring road	8.8	51	6
2	Kharwarnagar-sachine GIDC junction	9.4	50	5
3	Tadwadi circle-vrudavan	1.7	9	5
4	Sahara darwaja-sabargam collage	5.0	14	4
5	Adajan-jahanipura	4.4	15	3
6	Athwa junction-airport	4.9	16	3
7	Railway sation to valak gam BRTS	9.2	29	4
8	Y junction-karwarnagar	4.3	13	3
9	ONGC Circle- schine GIDC Jun	19.7	58	33
10	Sachin GIDC-Toll naka	7.4	21	3

(Sources: Comprehensive mobility plan 2035)

3.1 Multi Criteria Decision Making Method: Background

The earliest multi-criteria decision making (MCDM) techniques were created in the 1960s to aid decision-makers in resolving conflicts between divergent opinions and navigating enormous volumes of complex data. Multi-Criteria Decision Making (MCDM) models are useful for assessing and selecting the best possibilities among alternatives to determine the ideal criterion. In order to help decision-makers navigate vast amounts of complex data and resolve conflicts between conflicting perspectives, the early multi-criteria decision making (MCDM) tools were developed in the 1960s. The best options among alternatives can be evaluated and chosen to find the optimal criterion using Multi-Criteria Decision Making (MCDM) models. The purpose of MCDM techniques is to overcome the limitations of unstructured individual or group decision-making by employing systematic analysis to evaluate and choose solutions based on a wide range of criteria. Simple techniques can be applied in MCDM.

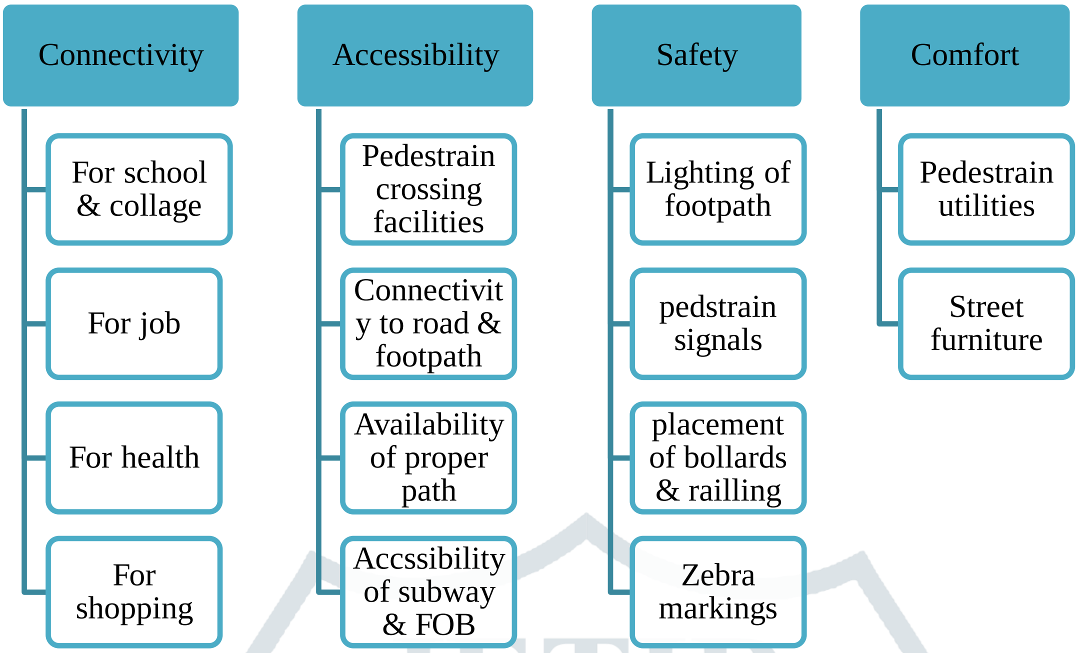
3.2 Analytic Hierarchy Approach

The Analytic Hierarchy Process (AHP) is a structured decision-making method developed by Thomas L. Saaty in the 1970s. It is widely used to solve complex decision problems by breaking them down into a hierarchical structure of criteria and alternatives. The Analytic Hierarchy Process (AHP) is a decision-making technique that helps in selecting the best option from a set of alternatives. It involves breaking down a complex decision problem into a hierarchical structure of criteria and sub-criteria, then comparing them pairwise to determine their relative importance. Through mathematical calculations, AHP derives priority weights for each criterion and alternative, facilitating a systematic and structured decision-making process.

The criteria are the factors or attributes that contribute to achieving the goal. These are typically divided into sub-criteria to represent different aspects of the decision problem. Alternatives: The alternatives are the possible courses of action or solutions to the problem. Pair wise Comparisons: Once the hierarchy is formed, decision-makers are asked to make pair wise comparisons between elements at each level of the hierarchy. For example, they compare criteria with respect to the goal, sub-criteria with respect to their parent criteria, and alternatives with respect to criteria. Decision-makers assign numerical values to indicate the relative importance or preference between pairs of elements. The scale typically ranges from 1 to 9,

3.2.1 AHP Method to Determine Most Significant Criteria's:

The Analytical Hierarchy Process, I have chosen four primary criteria and some auxiliary criteria for each of those four primary criteria. To ascertain the intensity of several characteristics for precise analysis in the paired comparison, 5 expert opinion surveys were carried out. Manual to ascertain the most important criteria for pedestrian safe movement planning, computation is used in Multiple-Criteria Decision Making (MCDM).



3.2.2 Steps of data Analysis

Step 1: : Pair wise comparison matrix:

Criteria	connectivity	Accessibility	Safety	comfort
Connectivity	1.00	2.00	2.00	3.00
Accessibility	0.50	1.00	2.00	3.00
Safety	0.50	0.50	1.00	2.00
Comfort	0.33	0.33	0.50	1.00

These are the primary standards used by the experts in their pair wise comparisons, and they provide the scale for one another. According to Saaty's relative relevance scale, scaling ranges from 1 to 9.

Step 2: Normalized pair wise comparison matrix:

All the elements of the column are divided by the sum of the column and thereafter average of each row is calculated and it is called the criteria weight shown in table which is used to prioritized each criteria.

Criteria	Connectivity	Accessibility	Safety	Comfort	Criteria weight
Connectivity	0.429	0.522	0.364	0.333	0.412
Accessibility	0.214	0.261	0.364	0.333	0.293
Safety	0.214	0.130	0.182	0.222	0.187
Comfort	0.143	0.087	0.091	0.111	0.108

Step 3: Calculating the consistency

Compute the Eigen value first (λmax). By multiplying the right of judgement matrix by the priority vector or eigenvector and generating a new vector, one may determine the eigen value (max). λmax Calculate by the average of all (weighing sum/ Criteria weight) values.

Criteria	Connectivity	Accessibility	Safety	Comfort	Sum weight	Criteria weight	Avg.
Connectivity	0.4118	0.5861	0.3744	0.3239	1.6961	0.4524	3.7494
Accessibility	0.2059	0.2930	0.3744	0.3239	1.1972	0.2365	5.0624
Safety	0.2059	0.1465	0.1872	0.2159	0.7555	0.1734	4.3569
Comfort	0.1373	0.0977	0.0936	0.1080	0.4365	0.1377	3.1694

Step 4: Final weight for main criteria

All the parameters are calculated one through this method and check the consistency of the parameters. Table shows the weightage of the parameters and final weight represent the weight of particular sub parameters in whole weight.

Main criteria	Main criteria weight	Sub criteria	Code	Sub criteria weight	Rank
Connectivity (A)	0.4524	For school & collage	A1	0.416	1
		For job	A2	0.235	7
		For health	A3	0.339	4
		For shopping	A4	0.148	12
Accessibility (B)	0.2365	Pedestrians crossing facilities	B1	0.356	2
		Connectivity to road & footpath	B2	0.303	6
		Availability of proper path	B3	0.231	8
		Accessibility of subway & FOB	B4	0.106	14
Safety (C)	0.1734	Lighting of footpath	C1	0.352	3
		pedestrians signals	C2	0.312	5
		placement of bollards & railing	C3	0.202	11
		Zebra markings	C4	0.129	13
Comfort (D)	0.1377	Pedestrians utilities	D1	0.220	9
		Street furniture	D2	0.210	10

4. Concluding remark

In conclusion, the integration of Analytic Hierarchy Process (AHP) methods into planning for pedestrian safety in Surat City offers a structured and effective approach to addressing the critical issue of pedestrian safety. By systematically evaluating and prioritizing safety interventions based on various criteria such as pedestrian Connectivity, accessibility, safety, comfort, AHP facilitates informed decision-making. This method ensures that urban planners can select the most suitable and impactful interventions to enhance pedestrian safety on Surat City's roads. Ultimately, by incorporating AHP methods, Surat City can create safer and more pedestrian-friendly urban environments, promoting sustainable mobility and improving the overall well-being of its residents.

These criteria are essential for evaluating the effectiveness of potential safety interventions. Secondly, AHP allows researchers to assign weights to each criterion based on their relative importance. This weighting process ensures that the most critical factors receive appropriate consideration during the decision-making process. The result concluded that connecting for pedestrian criteria holds a top position among the all criteria with weight of 0.412. accessibility, safety and Comfort are hold second, third, fourth position with the weight of 0.293, 0.187, 0.108. Ultimately, by implementing these measures, we can foster a community that values pedestrian safety, promotes active transportation, and enhances overall quality of life.

5. References

1) Indian road congress(IRC:103-2012)
2) Street for people (pathway of change from India's smart cities)
3) Mona Fernando, Goran Smith, Elisa Conticelli, Pedestrian Network Concept: A Systematic Literature Review, 2023 https://doi.org/10.1016/j.urbmob.2023.100051
4) Alireza Mohmmadi, Behzad Kiani Hasan,2023, Pedestrian Road Traffic Accidents in Metropolitan Areas: GIS-Based Prediction Modeling of Cases in Mashhad, Iran, ,Sustainability 2023, 15, 10576. https://doi.org/10.3390/su151310576
5) James Damsere-Derry, Nicholas Anarfi Bofah,2023, Road safety benefits and challenges associated with pedestrian footbridge patronage along the Madina-Adenta highway, https://doi.org/10.1080/21650020.2023.2193240
6) Laxman Singh, Geetam Tiwari, 2023, Identification of road traffic crashes hotspots on an intercity expressway in India using geospatial techniques, http://creativecommons.org/licenses/by-nc-nd/4.0/
7) Ahmad Ilderim Tokey , Shefa Arabia Shioma, Muhammad Salaha Uddin, 2023 Assessing the effectiveness of built environment-based safety measures in urban and rural areas for reducing the non-motorist crashes,
8) Tarek Al Shammas, Pedro Gullon, Olivier Klein ,Francisco Escobar, 2023, Development of a GIS-based walking route planner with integrated comfort walkability parameters, https://doi.org/10.1016/j.compenvurbsys.2023.101981
9) H. Hendrawan, S. Amelia, 2022 Criteria for the Development and Evaluation of the Implementation of a Sustainable Pedestrian Bridge, Science and Technology Research Symposium (SIRES), KnE Life Sciences, pages 175–186.
10) Dipanjan Mukherjee, Sudeshna Mitra, 2022, What affects pedestrian crossing difficulty at urban intersections in a developing country?, DOI 10.18502/kls.v7i5.12524
11) Avinash Chaudhri, Ninad Gore, Shriniwas Arkatkar, Gaurang Joshi, 2021 Exploring Pedestrian Surrogate Safety Measure By Road Geometry At Midblock Crosswalk: A Perspective Under Mixed Condition ,https://doi.org/10.14445/23488352/IJCE-V9I9P101
12) Shafina Shukkoor, Sangeeth K, 2021,Pedestrian Planning in Kollam City, https://doi.org/10.1016/j.iatssr.2020.06.001
13) Shivani Bhoyar, Dr.B.V.Khoda, Jitesh Bhoyar, Renu Upadhyay, 2021, A Proposal of Foot Over Bridge at Congested Intersection,
14) Rajeswari.K, 2021,Walkability In Urban Pedestrian Environment, https://doi.org/10.32628/IJSRST218384
15) Ish Kumar, 2021Pedestrian Safety and Travel Behavior, , International Journal of Creative Research Thoughts (IJCRT) www.ijcrt.org
16) Neeraj S. N, Rajendra Khatawkar, 2021 Pedestrian Crossing Behaviour Analysis at Intersections of Mysuru City, , www.rspsciencehub.com
17) The Need of Pedestrian Footbridge to Promote Sustainable Living; Case Study: Footbridge Jln A Yani Pabelan, Kartasura, Yayi Arsandire, Anggita Danuputra, 2020, www.ijera.com